EVALUATION OF LOW TEMPERATURE THERMAL SYSTEMS FOR TREATMENT OF SOILS CONTAINING CYANIDE

Four processes X*TRAX™, LTTA, ATP AND LT^3 were evaluated for its capability for treating soils/waste containing cyanide. XTRAX is developed by Chemical Waste Management, LTTA and ATP are developed by Cannonie and LT^3 is developed by WESTON. For the purpose of evaluation all three vendors were contacted to determine treatability of cyanide using their thermal treatment process.

XTRAX SYSTEM

Chemical Waste Management were contacted to obtain the information on the treatability of soils containing cyanide. WESTON were informed that they had recently performed a treatability study for Feed Soil containing PAHs, chlorinated phenols and cyanide. The cyanide in the feed soil was approximately 2500 ppm. The cyanide was non-detected at 0.5 ppm in the treated soils when treated at high temperatures, not exceeding 850^0F.

LT^3

Technical contact for this process at WESTON informed that the feed soils from a confidential client contained 526 mg/kg of cyanide and after treatment with LT^3 approximately 50 percent reduction in cyanide was achieved.

Treatability of organics by this process is provided in Tables 1 and 2 attached with this memorandum.

LTTA AND ATP

Cannonie has not treated cyanide containing soils with their system. However, the technical contact informed Weston that he thinks cyanide can be desorbed and removed from the soils by ATP. However, a bench scale testing of soil is required prior to using the system for treating cyanide containing soils.

Publications

A paper "Seven Years Experience In Thermal Soil Treatment" was published in Forum on Innovative Hazardous Waste Treatment Technologies: Domestic and International, June 1989, Atlanta, Georgia. This is an international technology.

The results presented in the report suggest that the cyanide can be substantially desorbed from the soils using thermal soil treatment. Figure 1 is a graph from this report showing amount of cyanide removed from the contaminated soils.

The resulting cyanide vapors from all three processes can be destroyed by passing the vapors through afterburner.

Conclusions

The evaporation temperature for cyanide is 450^0C and if the above processes are operated at slightly higher temperature than 450^0C, then the cyanide can be desorbed from the soil and can be destroyed in an afterburner. Because the cyanide exists in different forms in the environment, a treatability or bench scale study must be done prior to using any of the above processes for treatment to confirm that the cleanup standards set for the site can be achieved.

TABLE 1

Results of Previous Bench-, Pilot-, or Full-Scale LT³ Projects

Date: September 23, 1988
Client: Confidential
Location: Engineering Technology Laboratory, Lionville, PA
Description: Bench-Scale LT³ Testing on Petroleum Hydrocarbon Contaminated Soil
Processed Soil Temperature: 450°F
Processed Soil Residence Time: 30 Minutes

Contaminant	Boiling Point (F)	Feed Soil Concentration	Processed Soil Concentration	Contaminant Removal Eff. (%)	Concentration in TCLP Leachate (ppb)
Oil and Grease (By IR)	N/A	100,000 ppm	170 ppm	99.82%	(Not Analyzed)
Naphthalene	424 F	23,000 ppb	< 330 ppb	> 98.57%	1J
Carcinogenic Priority PNA's					
Benzo(a)anthracene	850 F	66,000 ppb	< 330 ppb	> 99.50%	N/D*
Benzo(a)pyrene	923 F	110,000 ppb	< 330 ppb	> 99.70%	N/D*
Benzo(b)fluoranthene	896 F	90,000 ppb	< 330 ppb	> 99.63%	N/D*
Chrysene	875 F	80,000 ppb	< 330 ppb	> 99.59%	N/D*
Dibenzo(a,h)anthracene	975 F	19,000 ppb	< 330 ppb	> 98.26%	N/D*
Non-Carcinogenic Priority PNA's					
Acenaphthene	534 F	28,000 ppb	< 330 ppb	> 98.82%	N/D*
Acenaphthalene	518 F	20,000 ppb	< 330 ppb	> 98.35%	2 J
Anthracene	644 F	49,000 ppb	< 330 ppb	> 99.32%	1 J
Benzo(g,h,i)perylene	995 F	19,000 ppb	< 330 ppb	> 98.26%	N/D*
Benzo(k)fluoranthene	896 F	59,000 ppb	< 330 ppb	> 99.44%	N/D*
Fluoranthene	707 F	57,000 ppb	< 330 ppb	> 99.42%	N/D*
Fluorene	560 F	55,000 ppb	390 ppb	99.29%	7 J
Ideno(1,2,3-c,d)pyrene	950 F	65,000 ppb	< 330 ppb	> 99.49%	N/D*
Phenanthrene	644 F	52,000 ppb	20 ppb J	99.96%	N/D*
Pyrene	759 F	50,000 ppb	< 330 ppb	> 99.34%	N/D*
Volatile Organic Compounds					
1,1,1 Trichloroethane	165 F	2,600 ppb	< 250 ppb	> 90.38%	N/D*
Moisture	212 F	21.80 %	0.01 %	99.95	N/A

Notes:
N/A - Not Applicable
N/D* - Not Detected. Detection Limit = 20 ppb
"J" - Present at Less Than Detection Limit

TABLE 2

LT³ Testing Summary

WESTON has tested and has collected treatability data for the generic and specific waste contaminants listed below. Due to ongoing tests of new materials and compounds, the list below is not complete.

Generic Waste Contaminants

Coal Tar
Drill Cuttings (Oil Based Mud)
Diesel Fuel (No. 2)
Leaded Gasoline
Unleaded Gasoline
Jet Fuel (JP4)
Petroleum Hydrocarbons
Solvents
Halogenated Solvents

Specific Contaminants

Volatiles

Acetone
Benzene
Carbon Tetrachloride
Chloroform
Chloromethane
1,1,1-Dichloroethane
1,2-Dichloroethane
1,1,1-Dichloroethene
trans-1,2-Dichloroethene
2-Hexanone
Methylene Chloride
1,1,2,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Tetrachloroethene
Tofuene
Trichloroethane
Vinyl Chloride

Semi-Volatiles

Ethyl Benzene
Naphthalene
Xylene

Polynuclear Aromatics (PNA's)

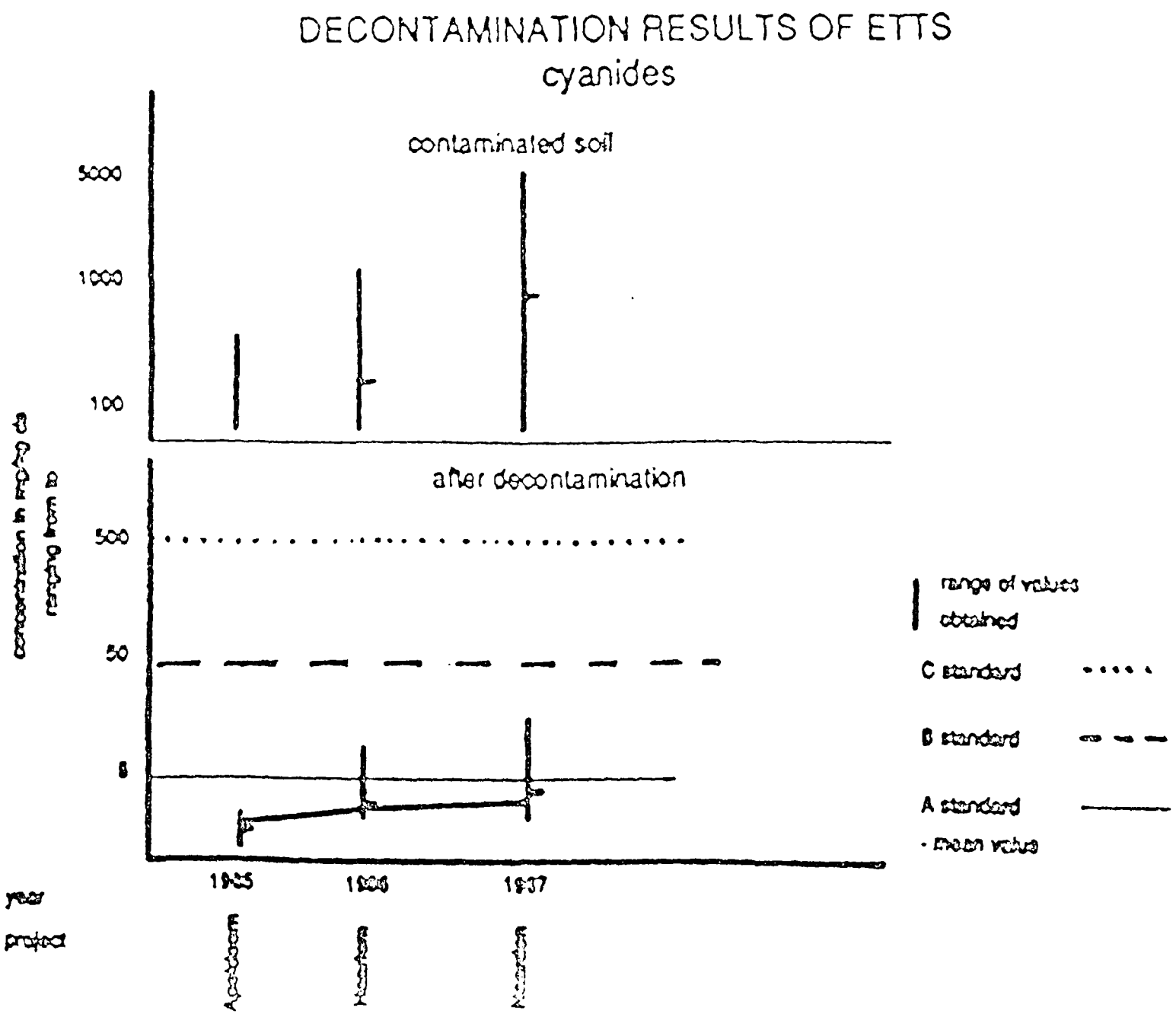
Carcinogenic

Benzo (b) Fluroanthene
Chrysene

Non-Carcinogenic

Acenaphthalene
Anthracene
Fluoranthene
Fluorene
Phenanthrene

FIGURE 1


DECONTAMINATION RESULTS OF ETTS
cyanides
contaminated soil
5000
1000
100
after decontamination
500
50
0
1985
1986
1987
range of values obtained
C standard
B standard
A standard
mean value